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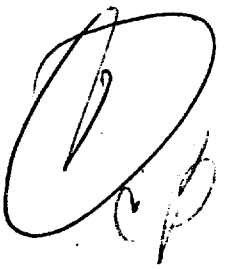

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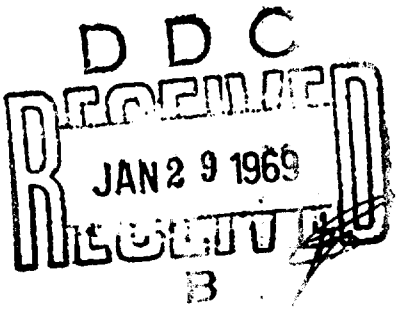

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The cutaneous lymph vessels of the guinea pig. (Second contribution to the lymphangial system of the most frequently used experimental animal, Cavia porcellus L. cobaya).

by Gerhard Keller

Z. f. Infektionskr., parasit. Krankh. u. Hygiene d. Haustiere, 52: 250-266 (1937).

Introduction.

Since the extensive investigations of Baum and recently, of Grau, showed that the lymphangial systems of the various animal species are not identical in their anatomical structure, I started with the examination of a species which plays an important role as an experimental animal, namely the guinea pig. In the first contribution to this series (Winkelmann, 1937), a basic preface is given, to which the reader is referred.

Material and technique.

The findings of Winkelmann (1937) illuminate the question of the lymph gland. I have examined the position of the macroscopically visible lymph vessels of the skin of twelve guinea pigs of different ages and sex. I obtained my material partly from the Zoological Institute, partly from the farm of our institute.

The l. (= lymphangia) were filled according to Gerota's method of injecting animals killed with ether (Baum, 1928). The number of l. that fill upon local injection is quite variable. Often extravasates were noted, from which small reticula were formed that developed into from one to five l. The l. often proceeded simultaneously to different lymph nodes. The l. of newly killed animals were somewhat more easily filled than those of animals that had been stored in the cooler for up to 10 days. Best observations of the progression of l. could naturally be made with large guinea pigs. Frequently the course of l. could be followed only with the aid of a magnifying glass. A filling of the smallest l., e.g. in the pads, could not be demonstrated macroscopically due to the guinea pig's small size.

Personal findings.

a) Preliminary remarks.

The correlation of l. to the cutaneous muscles is quite variable. For the most part they proceed from the point of puncture for a long distance immediately below the skin and above the cutaneous muscle. Less frequently they enter into or even penetrate the muscle in order to get to its other side.

While the l. of the horse and of cattle relatively seldom form a mesh or reticulum by partition and merger of branches, this occurs more frequently in the guinea pig (similarly to the dog). Such a network generally covers the entire lateral chest wall between the tenth and last rib, and thus forms the

lymph-sheath between the l. leading to the ln. (= lymphonodulus) axillaris accessorius and ln. subiliacus. This lymph-sheath is situated at the lateral thoracal wall at the height of a segmental line drawn through the last rib.

Similarly to Baum (cattle, horse and dog) and Grau (sheep), I was also able to observe, in the guinea pig, the crossing of l. from one half of the body across the median line to a node located in the other half (Fig. 1, g). There were only a few such crossings from extravasates in the dorsal area, however.

The following lymph glands of the cutaneous region are to be considered (cf. also Schauder, 1923, Winkelmann, 1937):

1. The lc. (= lymphocentrum) parotideum (Fig. 1, 4) consists of two lymph glands of hemp seed to lentil size. They lie superficially under the skin, close by and caudad to the temporomaxillary articulation, imbedded in the glandula parotidea at the caudal edge of the v. temporalis superficialis. The cutaneous l. of the ear, the frontal region and the area surrounding the eyes meet here.

According to Winkelmann (1937) the lc. parotideum is divided into the ln. parotideus proper, which lies closely behind the temporomaxillary articulation, and the ln. retropharyngealis lateralis at the auricular fundus. The location of the lymphangia tends to support Winkelmann's concept.

2. The ln. mandibularis (Fig. 1, 3) lies under the platysma, composed of two layers, of which the upper layer originates in the regio masseterica and the lower in the region of the neck, along the median line. They meet at the ventral median. The lymph gland is situated at the ventral edge of the m. masseter at the inferior maxillary arch on the site of the division of the v. jugularis. It is not quite the size of a lentil. Its caudodorsal edge borders on the glandula parotidea. The l. of the external nose, the nose ridge, the cheeks, the masseter region, most of those of the lower lip, the parotid area and the esophagus drain into it.

3. The lc. submentale (Fig. 1, 2 and 2, 1). It corresponds to the lymph gland which, in man, lies at the junction of both rami of the lower jaw, at the dorsal side of the incisive alveoli on the m. mylohyoideus, near the frontal belly of the m. digastricus (Bartels, 1909). In the guinea pig it consists of 2 to 3 glands situated medially below the cutaneous muscle, being the size of a hempseed. The l. of the skin of the lower lip, the esophagus and part of the buccal area lead to them.

4. The ln. buccalis (Fig. 1, 1) (*) lies at the frontal edge of the m. masseter, above the m. zygomaticus on the n. infraorbitalis and on the n. buccalis. It is not found in the horse, in cattle, in the dog and sheep; in man, 3 glands are found at the indicated site (Bartels, 1909). The l. of the skin of the upper lip, the lower lip and the deep l. of the nose tip lead here.

(*) According to Falke (1937) there is also a "ln. facialis," situated more aborally.

5. The ln. cervicalis superficialis (cranialis) (Fig. 1, 5 and 2, 3), also called the "bow" lymph node, occurs singly, is rather large (7 mm long) and more cylindrical. It is covered by the m. omotransversarius and the ventral border section of the m. trapezius at the frontal edge of the m. supraspinatus, imbedded in fat. Its lower surface borders on the m. serratus ventralis cervicalis. It represents the terminus of the l. of the skin in the parietal region, the neck, the throat, the dorsal thoracal wall and the skin of the chest and the masseter region.

6. The ln. axillaris proprius (cranialis) (Fig. 2, 4) is a lymph gland situated at the medial plane of the m. teres major, in the angle formed by the a. and v. subscapularis and the a. and v. thoracicodorsalis, together with the a. and v. brachialis. In one case a gland was also found on the right side, which lay dorsally to the one just described. The ln. axillaris proprius (cranialis) receives a small portion of the l. of the skin of the dorsal, lateral and ventral thoracic wall.

7. The ln. axillaris externus s. accessorius (caudalis) (Fig. 1, 6), found in all cases, is situated dorsad and caudad from the olecranon on the m. latissimus dorsi, between the m. deltoideus and the caput longum of the m. triceps brachii, on the fourth to the fifth rib (in the fourth intercostal space). It is covered only by the external skin and the muscle of the abdominal skin. The l. of the skin of the upper arm, the lower arm, the carpus and the foot end here, as well as the l. of the skin of the thoracal wall and the frontal abdominal wall in their full height.

8. The ln. "cubitalis" (Fig. 2, 6) occasionally is found ventrocaudad from the ln. axillaris proprius (cranialis) at the shoulder joint, imbedded in fat, medially at the upper arm above the elbow joint, between the m. biceps brachii on one hand, and the caput mediale of the m. triceps brachii and the m. tensor fasciae antebrachii on the other, on the v. brachialis and the n. medianis, in the form of a millet seed-sized node. It was found once in six examinations, and only at the right limb. No cutaneous l. were seen leading to it.

9. The lc. subiliacum (Fig. 1, 7 and 2, 5) consists of 3-4 rather closely situated individual nodes of barley corn to lentil size, imbedded in fat. They lie in the middle between the tuber coxae and the patella at the cranial edge of the m. tensor fasciae latae, between the two blades of the knee fold, of which the outer forms a fleshy layer of the abdominal skin muscle, continuing into the area of the hip, and the other reaches onto the medial plane of the thigh in the form of a thin fascia.

In two cases the distance between the two glands amounted to barely 1½ cm, so that the lower gland lay ventrad from the knee fold. The upper node receives the cutaneous l. of the dorsalateral and ventrolateral abdominal skin, and the lower one, those of the lateral side of the thigh and the geniculate region, the leg (also from the craniomedial side), the scrotum, the prepuce, the udder and the vulva.

10. The ln. popliteus (Fig. 1, 8) is the size of a hempseed. It is found relatively close to the surface, on the heads of the gastrocnemius, in the muscular fold between the m. semitendinosus and the m. biceps femoris. It receives the cutaneous l. of the toes, the pelvic members, the lateral side of the tarsus, the medial and lateral side of the leg.

11. The ln. femoralis medialis is positioned on the medial side of the thigh, in front of the proximal terminus of the so-called femoral canal. It is the size of large grits. It is located on the forward edge of the m. gracilis and the caudal edge of the m. sartorius. It takes in the cutaneous l. of the medial side of the tarsus only (Fig. 1, b and 2, c).

b) The lymph vessels of the skin of the head.

In the head, inclusive of the region of the parotis and the esophagus, the lymph vessels (= l.) run mainly into the lc. parotideum and the ln. mandibularis, to a lesser extent into the ln. buccalis, ln. facialis (cf. above, Falke, 1937), ln. submentalis and ln. cervicalis superficialis (cranialis).

1. From the external nose (nose-tip, nose ridge, lateral nasal wall) the l. proceed primarily to the ln. mandibularis and, to a lesser extent, to the ln. submentalis. Upon injection into the skin of the nose tip, superficial and deep l. are filled. The superficial l. lead via the m. levator nasolabialis and m. buccalis to the v. facialis; they cross the m. masseter and lead into the ln. mandibularis. The deep l. lead from the nose tip across the m. levator nasolabialis, slightly below the m. zygomaticus into the ln. buccalis.

From the nose ridge the l. also lead via the m. levator nasolabialis, m. malaris and m. masseter to the ln. mandibularis.

The l. of the skin of the lateral nasal wall are located similarly.

2. The cutaneous l. of the lips. Proceeding from the upper lip, the l. drain via the m. levator nasolabialis into the ln. buccalis. They originate at the root of the m. levator nasolabialis.

The cutaneous l. of the lower lip run close to the ventral edge of the lower jaw and flow into the ln. mandibularis. A small portion proceeds to the ln. submentalis and ln. buccalis.

3. The l. of the esophageal skin generally lead along the ventral edge of the lower jaw caudad to the ln. mandibularis. A few l. terminate in the ln. submentalis after a short stretch.

4. In the buccal region, the l. primarily join with those coming from the nose tip and proceed via the m. masseter to the ln. mandibularis. The l. of the frontal buccal region drain into the ln. submentalis and the l. of the dorsal part drain into the lnn. parotidei.

5. The cutaneous l. of the masseter region all lead to the ln. mandibularis, without, however, revealing Falke's ln. facialis upon injection. In one case the ln. cervicalis superficialis (cranialis) was also involved.

6. The l. of the skin of the ocular and frontal regions lead under the skin to the orbital edge of the frontal bone via the temporal fossa to the lnn. parotidei.

7. From the parietal region, the l. converge and join in part, in order to proceed around the auricular fundus, directly to the lnn. parotidei. Part of the l. change direction at the dorsal edge of the ear and, together with the l. of the neck, drain into the ln. cervicalis superficialis (cranialis).

8. The cutaneous l. of the parotid region divide almost evenly and lead into the ln. mandibularis and the ln. cervicalis superficialis (cranialis). The lnn. parotidei do not receive any l. (similarly to the dog). The ln. mandibularis is reached by the shortest route, and the l. lead to the ln. cervicalis superficialis (cranialis) via the lateral plane of the throat.

9. Starting at the auricle, the l. lead into the lnn. parotidei. The l. run from the outer auricular tip, not far from the cranial and caudal edge, via the auricular ridge to the auricular fundus. Here they turn caudad and lead directly into the nodes. The same is true of the cutaneous l. of the inner auricular surface.

c) The lymph vessels of the jugular skin.

The cutaneous l. of the cervical and jugular regions terminate in the ln. cervicalis superficialis (cranialis). They proceed from the various cervical sites of injection, converging and partly joining, to the shoulder and penetrate at the edge of the m. omotransversarius to the deep lymph gland. Such a converging course was also observed at the throat.

d) The cutaneous l. of the shoulder members.

The l. of the skin of the shoulder members all lead to the ln. axillaris externus s. accessorius (caudalis). It receives the l. of the skin of the toes, the metacarpus, the carpus, the forearm, the upper arm, and the region of the shoulder.

The l., originating at the points of puncture of the individual toes, on the carpus and the forearm, all turn from the volar and lateral side, by the shortest route, to the v. cephalica accessoria. Two to four l., with the exception of those of the toes, usually join to form one to two thicker branches. These confluences usually take place in the area of the metacarpus and carpus. The joined branches proceed on the lateral side of the shoulder members with the v. cephalica accessoria up to a point slightly above and cranial to the elbow joint, in the direction of the shoulder. They then turn caudad and lead via the caput longum of the m. triceps brachii, covered by the cutaneous muscle of the traunk, to the rear edge of the shoulder-upper arm musculature, and thus reach the ln. axillaris externus s. accessorius (caudalis).

The cutaneous l. of the medial side of the toes, the metacarpus, the carpus and the forearm join together similarly to the lateral side. They join to a smaller extent (primarily those of the toes) the v. cephalica antebrachii,

in order to continue alongside for a short distance toward the shoulder. Soon they turn from the medial side to the lateral side. From the cranial part of the medial side, the transition is dorsad to the lateral side, from the caudal part this change is volar. The conjoined branches unite with those of the lateral side and also continue caudad, craniad and dorsad from the elbow joint, and proceed at some depth along the muscular sulcus formed by the muscles of the anconal group and the m. deltoideus, to the appropriate lymphgland.

From the skin of the region of the lateral elbow joint and the lateral shoulder-forearm, the l. proceed on the caput laterale directly dorsad underneath the abdominal skin muscle to the ln. axillaris externus s. accessorius (caudalis).

From the skin located medially on the elbow and medially on the upper arm, the l. also lead to the ln. axillaris externus s. accessorius (caudalis) by turning to the lateral side partly in a volar direction, partly dorsad. They then unite with the l. of the lateral side.

e) The lymph vessels of the skin of the thoracal wall.

1. The cutaneous l. of the dorsal thoracal wall (dorsal region) lead in the area of the first to the sixth thoracic vertebrae to the ln. cervicalis superficialis (cranialis) and caudad therefrom to the ln. axillaris externus s. accessorius (caudalis); behind the segment of the last rib, i.e. beginning at the lymph-sheath (the location of which was described above), they pass into the lc. subiliacum.

The l. leading to the "bow" lymph gland show a converging course from the points of puncture. Two to three usually combine. They are situated on the abdominal skin muscle. They penetrate between the m. trapezius and the m. omotransversarius and enter the gland.

The l. leading to the ln. axillaris externus s. accessorius (caudalis) are situated on the abdominal cutaneous muscle and reveal a converging course. They penetrate the muscle in the proximity of the gland.

The conditions are identical with the l. leading to the lc. subiliacum.

In the dorsal region the median plane is surpassed in a few places by l. (Fig. 1, g).

2. At the lateral thoracal wall the l. proceed to the ln. axillaris externus s. accessorius (caudalis) and to the lc. subiliacum. A small part of the cutaneous lymph vessels of the lateral thoracal wall may lead to the ln. axillaris proprius (cranialis) (Fig. 1, a) and the ln. cervicalis superficialis (cranialis).

The ln. axillaris externus s. accessorius (caudalis) receives l. which, from their point of puncture located at the next-to-the-last rib at the lateral-dorsal wall, run a converging, craniad course. Initially they are

situated above the abdominal skin muscle; the second half of the way they run below it on the m. latissimus dorsi.

Another l., originating at an extremely ventral location, i.e. more in the region of the lower thorax, accompanies the v. thoracia dorsalis in a cranial direction beneath the shoulder-upper arm musculature to the ln. axillaris proprius (cranialis) (Fig. 2, d).

From the ventral part of the lateral thoracic wall, the l. converge and lead on the abdominal cutaneous muscle to the ln. axillaris externus s. accessorius (caudalis).

The lc. subiliacum acts as receptor starting at the lymph-sheath in a caudal direction.

3. The l. of the skin of the upper and lower thorax lead into the ln. cervicalis superficialis (cranialis), the ln. axillaris externus s. accessorius (caudalis) and the ln. axillaris proprius (cranialis) (Fig. 2).

From the skin of the upper thorax, the l. proceed above the m. pectoralis superficialis, converge and enter the deep "bow" lymph gland at the m. omotransversarius (Fig. 1 and 2).

From the lower thorax, the l. join the blood vessels of the upper arm on the medial side of the shoulder and accompany them to the ln. axillaris proprius (cranialis). Part of the l. lead dorsad on the thoracal wall, at the caudal edge of the elbow, unite with the l. of the lateral thoracal wall and enter directly into the ln. axillaris externus s. accessorius (caudalis) (Fig. 2a)

f) The lymph vessels of the skin of the abdominal wall.

1. The cutaneous l. of the dorsal abdominal skin lead from the lymph-sheath onto the abdominal skin muscle, converge and enter the lc. subiliacum. In the dorsal region the median plane is again overstepped by some l. originating in extravasates.

2. From the lateral, soft abdominal wall, the l. join the l. of the lateral thoracic wall (located caudad from the lymph-sheath), converge and unite in part, and enter the lc. subiliacum.

3. From the ventral abdominal wall, the l. originating in the proximity of the median plane, also lead to the lc. subiliacum.

4. From the umbilical region, the l. proceed to the lc. subiliacum, as do those of the scrotal and preputial skin.

5. From the skin of the udder, the l. lead to the farthest ventral node of the lc. subiliacum, after having consolidated the l. emanating at the teats.

6. The l. form reticula at the opening of the vulva. From these, one l.

emanates on either side, absorbs small l. from the sides, prescribes an arc which passes craniad of the udder, and also enters the ventral gland of the lc. subiliacum.

g) The lymphangia of the skin of the pelvis, the pelvic members and the tail.

The cutaneous l. of the pelvis, the pelvic members and the tail enter the lc. subiliacum, the ln. popliteus and the ln. femoralis medialis. The lc. subiliacum receives the l. of the pelvic region, the root of the tail, the lateral side of the thigh and the lateral side of the knee; in part even those of the medial side of the leg.

The ln. popliteus receives the l. of the toes of the pelvic members, the lateral side of the tarsus, the medial and lateral side of the leg.

The ln. femoralis medialis receives the l. of the skin of the medial side of the tarsus and the medial side of the leg (Fig. 1, b and 2, c).

1. The cutaneous l. of the pelvis and the sacral region lead to the lc. subiliacum. From the points of puncture in the region of the last lumbar vertebrae and the sacrum, the l. proceed above the trochanter major, after having consolidated several branches.

In one case the cutaneous l. of the cranial two-thirds of the pelvic region did not lead as usual to the knee fold, but ran craniad, then subfascially to the dorsal abdominal wall, penetrated the abdominal cutaneous muscle in the region of the kidneys and entered the deep ln. renalis (Fig 1 c).

2. A thick l. develops from the skin of the caudal stump, leading from the caudal root around the caudal edge of the pelvis to the medial side of the thigh; it penetrates the medial blade of the knee fold close to the gland and enters the lc. subiliacum (Fig. 1).

3. The cutaneous l. of the thigh run to the lc. subiliacum.

From the lateral side of the thigh, the l. originating primarily on the leading edge of the thigh penetrate the cutaneous muscle, converge thereon, then lead to the lymph gland of the knee fold. The l. of the lateral side of the thigh, originating principally in the proximity of the trailing edge of the thigh, lead around the caudal edge of the pelvic-femoral musculature to the medial side of the thigh. They proceed via the m. gracilis to the lc. subiliacum.

From the medial plane of the thigh, the l. pass laterally by the udder and join those emanating from the udder. None of the l. lead to the ln. femoralis medialis.

4. The cutaneous l. of the knee accompany those of the thigh to the lc. subiliacum. L. leading to the ln. popliteus were not seen.

5. The lc. subiliacum also receives the cutaneous l. of the leg.

Medial side of the leg: The l. originating on the leading edge of the leg lead from the distal part of the leg in the direction of the pelvis and, in the region of the proximal third, move around the leading edge of the tibial musculature (Fig. 1, d) to the lateral side of the leg (Fig. 1, d'); they then join the l. of the lateral plane of the thigh in leading to the lc. subiliacum. One l. entered the ln. femoralis medialis, after following the v. saphena (Fig. 1, b and 2, c).

The l. of the trailing edge of the medial side of the leg follow the trailing edge of the leg to the ln. popliteus.

Lateral side of the leg: The l. of the caudal plane of the leg enter the ln. popliteus, after following the course of the v. saphena parva. Part of the l. of the cranial side of the leg join those of the caudal side. Another part moves via the leading side to the medial plane at the proximal or central third; it then crosses the l. which accompany the v. saphena (cf. above) and moves across the medial tibial musculature to the ln. popliteus (Fig. 1).

6. The cutaneous l. of the tarsus lead to the ln. popliteus and the ln. femoralis medialis.

From the lateral plane, the l. rise upwards and join those of the lateral plane of the leg and (partly) enter the ln. popliteus.

The l. of the medial side rise upwards, close to the trailing edge along the tarsus, and enter the ln. popliteus together with the l. of the medial side of the leg. Another part of the l., consolidated into one, led along the v. saphena in the direction of the pelvis and terminated in the ln. femoralis medialis.

7. All of the cutaneous l. of the metatarsus and the toes enter the ln. popliteus.

The l. of the lateral side of the toes and the metatarsus progress across the caudolateral edge of the metatarsus and the tarsus, and accompany the v. saphena parva upwards to the ln. popliteus. A few turn to the flexor side of the tarsus and also lead to the ln. popliteus from here.

On the medial plane, the l. rise upwards from the toes; a few l. merge in the region of the proximal third of the metatarsus and turn partly around the dorsal, partly around the plantar side to the lateral plane (Fig. 1, d and d'). They then join the l. of the lateral planes of the toes, the metatarsus, the tarsus and the leg.

Comparative synopsis.

In my comparison of the cutaneous lymph vessls and glands of the guinea pig with those of other domestic animals, I should like to limit myself to two species, the sheep and the dog.

a) Lymph glands.

The lc. parotideum consists, as in the sheep, of 2 glands; only one large node has been found in the dog. While the glands are located closely below the temporomaxillary articulation in the sheep, they are found closely caudad in the guinea pig and dog.

The lc. retropharyngeale laterale, occurring in the sheep and dog, was not observed in the guinea pig. The gland situated at the auricular fundus in the lc. parotideum might be taken for it after Winkelmann (1937), as already mentioned.

While the lc. mandibulare consists of 1-2 nodes in the sheep, and of 2-5 in the dog, only one has been seen in the guinea pig.

I observed the lnn. submentales, buccales and faciales, which had not been found in domestic animals heretofore, occurring only in man (cf. above, Falke 1937).

While the ln. axillaris externus s. accessorius (caudalis) does not occur in the sheep, and is rarely found in the dog, it was regularly discovered in the guinea pig.

The lc. subiliacum, found in guinea pigs and sheep, is absent in the dog.

The lc. inguinale superficiale, present in the sheep and dog, is missing in the guinea pig.

The lc. iliacum of the guinea pig, in contrast to the sheep and dog, does not receive any l. of the skin. As in the sheep, the ln. iliacus lateralis seems to occur only as an exception.

The lc. sacrale is found only in the sheep, and not in the dog and guinea pig.

The ln. cubitalis, rarely found in the guinea pig, is always observed in man.

In all three of the species compared by me, the following lymph glands are identical: 1. The ln. cervicalis superficialis (cranialis). 2. The ln. axillaris proprius (cranialis), which, in the guinea pig, receives only a few l., however. 3. The ln. popliteus.

b) Lymph vessels.

Of the cutaneous l. of the head, those of the nose of the guinea pig and dog lead predominantly to the ln. mandibularis and (except in the dog) also to the ln. submentalis; not to the lc. parotideum, as in the sheep, and exceptionally to the lc. retropharyngeum. Since the guinea pig has a ln. submentalis, it represents the terminus for part of the labial, esophageal and buccal l., which is not the case in the other two domestic animals. While the l. of the parietal region lead to the lnn. parotidei (and the ln. cervicalis superficialis (cranialis)) in the guinea pig (and dog), they proceed only to the lnn. parotidei in the sheep. From the parotis area, no l. lead to the lnn. parotidei

in the guinea pig and dog, otherwise observed in the sheep. L. leading to the ln. cervicalis superficialis (cranialis) from the skin of the ear, as seen in the sheep and dog, were not found in the guinea pig.

The cutaneous l. of the shoulder members all lead to the ln. axillaris externus s. accessorius (caudalis) in Cavia, a ln. found rarely in the sheep and dog. In the sheep, the ln. cervicalis superficialis (cranialis), the ln. axillaris and ln. axillaris primae costae are primarily involved; in the dog, predominantly the ln. cervicalis superficialis (cranialis), the ln. axillaris and the ln. axillaris accessorius.

In the region of the thoracic wall (the upper thorax), the l. of the skin penetrate the chest muscles and enter the lnn. axillares primae costae. This course was not observed in the dog and guinea pig. At the lower thorax and the area of the navel, the l. in the sheep and the female dog led from the cranial 2-3 teats through the ventral thoracal wall into the thoracic cavity to the lnn. sternales; this, of course, could not be seen in the guinea pig.

The cutaneous l. of the abdominal wall, including the scrotum and prepuce, vulva and udder, all lead to the lc. subiliacum in the guinea pig. In the dog, in which this nodal group is absent, the ln. inguinalis superficialis, partly the ln. iliacus medialis, and to a lesser extent, the ln. axillaris are attained. The sheep has the ln. subiliacus for this area, occasionally the ln. ischiadicus and the lnn. inguinales superficiales.

From the skin of the pelvic members, the l. of the toes and the metatarsus without exception lead to the ln. popliteus in the guinea pig; in the dog and sheep only the major part of the l. proceed there. From the medial side of the tarsus, a l. rises upwards along the femoral canal or fissure with the v. saphena in all three species, its terminus is diverse, however: In the guinea pig it ends in the ln. femoralis medialis, as sometimes in the dog; in the sheep, however, it goes to the lnn. inguinales profundi.

The l. of the skin of the caudal stump enter the lc. subiliacum; this is not the case in the dog and sheep.

While reticular formations are relatively rare among the lymphangia of the sheep, this occurs far more extensively in the dog and guinea pig.

These comparisons of the cutaneous lymph vessels with their lymph nodes among only three species may suffice to reaffirm Baum's experiences to the effect that the lymphatic systems of the various animal species reveal a distinct deviation.

Illustrations.

Fig. 1. Lymph vessels of the skin of the guinea pig. Side view with representation of the cutaneous muscles.

Fig. 2. Lymph vessels of the skin of the guinea pig. Ventral view with representation of the cutaneous muscles.